Cirsotrema (Gastropoda: Ptenoglossa: Epitoniidae) in the Miocene Chipola Formation of northwestern Florida

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ABSTRACT

The genus *Cirsotrema* is represented in the Lower Miocene Chipola Formation by two species, *Cirsotrema dalli* Rehder, 1945, also present in the Pliocene and Pleistocene of southern Florida and extant in the western Atlantic, and *Cirsotrema cirritum* new species, found only in the Chipola Formation. A search of published records revealed no earlier occurrence of *Cirsotrema dalli* other than its presence in the Chipola Formation.

INTRODUCTION

The family Epitoniidae dates from the Triassic (Clench and Turner, 1950) and by the Cretaceous was well established with worldwide distribution. Sohl (1964: 317) created the genus *Striaticostatum* for seven species from the Cretaceous of the southeastern United States that have features similar to those now placed in *Cirsotrema* Mörch, 1852. The very faint spiral striations on the body whorl of *Striaticostatum* separate it from *Cirsotrema* which has stronger spiral sculpture. Palmer (1937) assigned five species from the Eocene of the southeastern United States to *Cirsotrema* from the Eocene of the same area.

Only two species of *Cirsotrema* have been found in the Lower Miocene Chipola Formation, restricted to that portion of the Chipola Formation in the Chipola River drainage of Calhoun County, Florida, in the region of Tennile Creek, Farley Creek, and the Chipola River, from State Road 20 north to the mouth of Tennile Creek. *Cirsotrema dalli* Rehder, 1945, a common species in the Pleistocene Bermont Formation of southern Florida (Hoerle, 1970) and extant in the western Atlantic (Abbott, 1974), is represented in the Chipola Formation by specimens from at least ten separate localities present in the Invertebrate Paleontology collection of the Florida Museum of Natural History at the University of Florida, Gainesville, Florida. Although found throughout the Chipola Formation, *Cirsotrema dalli* is uncommon at any particular locality. A species similar in shell morphology to *Cirsotrema dalli* from the tropical eastern Pacific, *C. togatum* Hertlein and Strong, 1951, ranges from Baja California south to the Galapagos Islands (Keen, 1971). *Cirsotrema togatum* has also been found in the Pliocene Esmeraldas beds of northwestern Ecuador (Pitt, 1981; DuShane, 1988). The new species, *Cirsotrema cirritum,* is also distributed throughout the Chipola Formation within the Chipola River drainage, but has been collected at only five localities and is rare. Three species exhibit a similarity to *Cirsotrema cirritum. Cirsotrema acutum* (J. Sowerby, 1813), from the Eocene Barton beds of Great Britain, *Cirsotrema crassicostatum* (Deshayes, 1850), found in the Miocene of Belgium, and *Cirsotrema excelsum* Garcia, 2003, a Recent species from the Indo-Pacific.

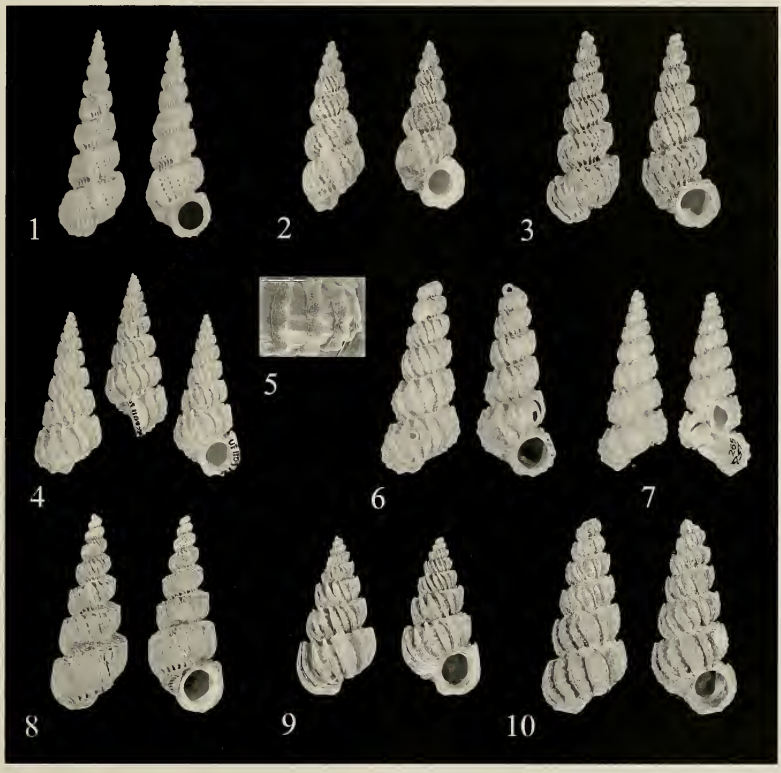
Institutional abbreviations used are: USNM, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; BMNH, British Museum of Natural History, London, England; RMNH, National Museum of Natural History/Naturalis, Leiden, The Netherlands; UF, Florida Museum of Natural History, The University of Florida, Gainesville, Florida, USA; BMSM, The Bailey-Matthews Shell Museum, Sanibel, Florida, USA; LACM, Los Angeles County Museum of Natural History, Los Angeles, California, USA. "P. Diegel collection" refers to the collection of Phyllis Diegel, West Palm Beach, Florida, USA. "Sunderland collection" refers to the collection of Kevan and Linda Sunderland, Sunrise, Florida.

SYSTEMATICS

Superfamily Janthinoidea Lamarck, 1812
Family Epitoniidae Berry, 1910
Genus *Cirsotrema* Mörch, 1852
Cirsotrema Mörch, 1852: 49.

Type Species: *Scalaria varicosa* Lamarck, 1822, by monotypy.

Diagnosis: Shell white to gray, turriculate; body whorl usually with broad spiral cords, often covered with fine spiral and axial lines forming microscopic reticulate sculpture. Raised axial lines forming microscopic reticulate sculpture. Raised axial costae composed of numerous lamellations, frequently foliated, sometimes covering entire body whorl, with or without prominent varices. All possess a basal ridge. Aperture circular to oval.



Figures 1–10. *Cirsotrema* species. **1.** *Cirsotrema dalli* Rehder, 1945, Recent, Anses d'Arlets, Martinique, height 43.8 mm, width 13.5 mm, P. Diegel collection. **2.** *Cirsotrema pilsbryi* McGinty, 1940, Recent, taken off St. Augustine, Florida, by Ted Yocius, height 15.3 mm, width 6.4 mm, Sunderland collection. **3.** *Cirsotrema dalli* Rehder, 1945, fossil, UF 45354, Chipola Formation, Tennile Creek, Calhoun County, Florida, height 18.3 mm, width 7.0 mm. **4–7.** *Cirsotrema cirritum*, new species. **4.** Holotype, UF 110972, height 30.1 mm, width 11.8 mm. **5.** Paratype, UF 112019, sculpture of teleoconch, scale bar = 5 mm. **6.** Paratype, BMSM 15301, height 54.1 mm, width 22.0 mm. **7.** Paratype, USNM 522028, height 50.4 mm, width 18.2 mm. **8.** *Cirsotrema* cf. *woodringi* Olsson, 1967 (= "*C. arcella* Rehder", Woodring, 1959), UF 112142, Gatun Formation, road cut east of Cativa, Province of Colón, Panama, height 36.0 mm, width 13.6 mm. **9.** *Cirsotrema acutum* (J. Sowerby, 1813), UF 112018, Barton Clay Formation, Barton on Sea, Hampshire, England, height 16.2 mm, width 7.7 mm. **10.** *Cirsotrema crassicostatum* (Deshayes, 1850), RMNH Lot 497 (No. 65166?), Zanden V. Antwerpen, height 37.3 mm, width 14.9 mm.

Cirsotrema dalli Rehder, 1945
(Figures 1, 3)

Cirsotrema (Cirsotremopsis) dalli Rehder, 1945: 128; Olsson, 1967: 40, pl. 5, figs. 2–2b.

Cirsotrema (Cirsotremopsis) arcella Rehder, 1945: 128; Olsson, 1967: 40, pl. 5, figs. 4–4a.

Cirsotrema arcella Rehder, Clench and Turner, 1950: 228, pl. 98, fig.3, [considered by Clench and Turner to be conspecific with *C. dalli*].

Cirsotrema dalli Rehder, Clench and Turner, 1950: 227–228, pl. 98, fig. 1, 3; Warmke and Abbott, 1961: 71–78, pl. 14, fig. H; Morris, 973: 154, pl. 44, fig. 1; Abbott, 1974: 114, fig. 1188; Humfrey, 1975: 91, pl. 7, fig. 12; Rios, 1975: 57, pl. 15, fig. 219; Abbott and Dance, 1982: 69; Sunderland, 1990: 14; Rios, 1994: 99, pl. 33, fig. 404.

Description: Shell medium to large, turriculate; teleoconch whorls 9 or 10, convex, with 5 or 6 broad spiral cords overlain with fine spiral and axial lines, forming a microscopic reticulated sculpture. Suture deep. Fimbrious axial costae composed of fine, wavy lamellae, with a crosshatched pattern inclined upwards abaperturally, hooked at shoulder, sinuous, with alternating waves so that each succeeding costa contacts abapertural costa, forming a secondary surface which is almost flat or slightly convex, leaving only very small holes or pits. Prominent varices present at irregular intervals. Aperture subcircular; with labral varix.

Holotype: USNM 515240

Type Locality: 29°14′ N, 85°29′ W, off Cape San Blas, Florida, in 25 fathoms.

Remarks: Some authors consider *Cirsotrema dalli* to be a junior synonym of the Recent *Cirsotrema cochlea* (G. B. Sowerby II, 1844) from the eastern Atlantic (Clench and Turner, 1950: 228; Weil, et al., 1999: 14). Also, *Cirsotrema cochlea* may be a junior synonym of *Cirsotrema pumicea* (Brocchi, 1814). A comparative study of the relationship between *C. dalli, C. cochlea,* and *C. pumicea* has not been made and is beyond the scope of this paper.

Cirsotrema togatum may be considered the eastern Pacific cognate of *C. dalli.* Both have fimbriated costae frequently covering the entire surface, similar overall shapes, and varices at irregular intervals. Both may also have costae of varying widths due to erosion, especially on fossil specimens. The costae of dead collected Recent specimens are frequently eroded, as are the early whorls of live-taken specimens, exposing the sculpture on portions of the body whorl. A figure of a Recent specimen of *Cirsotrema togatum* by Keen (1971, fig. 633) and figures of Pliocene specimens by Pitt (1981, figs. 2, 3) and DuShane (1988, figs. 10, 11, 12) show specimens morphologically similar to *C. dalli.*

DuShane (1974, figs. 54 and 55) illustrated two specimens of *Cirsotrema togatum.* DuShane's figure 54, a live-taken specimen, is similar to the Recent specimens examined by this author, with the costae extending up over the suture and onto the preceding whorl, the suture subdued by the surface sculpture, and lacking a noticeable shoulder on the whorls, giving a somewhat straight appearance to the whorl profile. DuShane's figure 55, the holotype, exhibits a definite indentation at the suture with shouldered costae and some exposed intercostal areas, very similar to the holotype of *Cirsotrema dalli.* The discrepancy between DuShane's figure 54 and the holotype of *Cirsotrema togatum* illustrated in figure 55 might be resolved by the description of the Recent specimen illustrated in figure 54 as a separate, new species.

Although somewhat similar to *Cirsotrema dalli, C. pilsbryi* McGinty, 1940, a Recent species endemic to the western Atlantic, is easily distinguished from this species. The wavy costae of *Cirsotrema dalli* touch each other to a varying extent, forming a secondary superficial surface and leaving only small holes or pits between the adherent portions of the costae, obscuring the surface of the whorl itself, while the costae of *C. pilsbryi* are more sloping at the shoulder, with a subdued hook, giving the surface of the costae a more rounded appearance than that of *C. dalli.* Also, the costae of *Cirsotrema pilsbryi* consist of wavy lamellations without the foliations or crosshatched effect of the costae of *C. dalli.* Both *Cirsotrema dalli* and *C. pilsbryi* have irregularly spaced varices, have a microscopic reticulated sculpture on the body whorl, and have broad spiral cords which angle slightly towards the apex adaperturally, rather than revolving parallel to the whorl, although the sculpture on the body whorl is frequently not visible under the secondary surface on *C. dalli.* The principal characteristics separating *Cirsotrema dalli* from *C. pilsbryi* are well illustrated in Sunderland (1989, 1990).

The Recent Indo-Pacific *Cirsotrema ernestoilaoi* Garcia, 2001, is easily separated from *C. dalli* by the trapezoidal shaped (with wide shoulder) profile of the whorl formed by the axial costae, and lack of pits or holes in the surface sculpture of *C. ernestoilaoi.*

Cirsotrema woodringi Olsson, 1967, a rare species currently found only in the Miocene Gatun Formation of Panama and the Pliocene Tamiami Formation at Sunnyland, Florida, has foliated costae similar to *C. dalli.* It differs by the straight line separating the costae, which abut, completely covering the surface of the whorl. *Cirsotrema dalli* has wavy costae leaving small pits or openings in the secondary surface formed by the costae. As Olsson so aptly stated in reference to *Cirsotrema woodringi* (also applicable to *C. dalli* regarding costae), "General surface has a finely porous texture resembling that produced by a linen cloth" (1967: 41). This feature may be attributed to intritacalx (D'Attilio and Radwin, 1971), a shell layer not well studied in the Family Epitoniidae.

Olsson (1967: 41) reported a specimen of *Cirsotrema dalli* from "McClellan Farm", a locality on the west bank of the Chipola River south of Tenmile Creek, which he stated "was carefully compared with the type of *C. dalli,* a Recent species, and no distinguishing difference could be found".

Cirsotrema cirritum new species
(Figures 4–7)

Description: Shell medium to large, turriculate. Early whorls missing on all specimens examined. First existing whorl of holotype (last protoconch whorl) with sculpture ranging from smooth to ¼ turn with several single microscopic wavy axial lamellae that gradually enlarge into foliated costae. No clear distinction between protoconch

and teleoconch present. Teleoconch with 8 tumid whorls. Suture deep. Axial costae 13 on last whorl, strongly recurved, hooked, and angled slightly adapertur ally on shoulder, extending in a straight line over suture; surface of costae composed of multiple wavy lamella with very fine irregular diamond or square pattern; pattern inclined abaperturally. Intercostal spaces variable, usually wider than costae, with 5 broad, rounded spiral cords, overlain with 8 to 12 much finer cords, crossed by equally fine axial growth lines so as to form a microscopic, reticulated pattern. Reticulated pattern continue from intercostal spaces to cover adapertural side of recurved costae. Top of wavy axial costae sharp. Broad spiral cords on intercostal spaces reproduced on abapertural surface of costae and angled 45° apically. Adaptertural surface of costae covered with wavy crosshatched lamellae. Fine line of demarcation separates leading edge of costae where joined by succeeding intercostal space. Anterior reflected projections on axial ribs of last whorl forming coarse, undulating basal ridge. Varices absent. Aperture holostomatous.

Holotype: UF 110972, height 30.1 mm, width 11.8 mm.

Paratypes: BMSM 15301, protoconch missing, height 54.1 mm, width 22.0 mm, 30°28.030′ N, 85°09.572′ W (= Tulane University locality TU 458), east bank of Chipola River, above Farley Creek, (SW ¼ Sec. 10, T1N, R9W), Calhoun County, Florida, Chipola Formation; USNM 522028, spire and aperture missing, height 50.4 mm, width 18.2 mm, 30°29.44′ N, 85°11.17′ W, (= Tulane University locality TU 951, = United States Geological Survey locality 26578), Tenmile Creek, about 2 km west of Chipola River, (SE ½ Sec. 12, T1N, R10W), Calhoun County, Florida, Chipola Formation; UF 67746, spire missing, height 29.8 mm, width 10.3 mm, 30°27.45′ N, 85°08.45′ W, (= Tulane University locality TU 825), Farley Creek at abandoned mill about 350 m west of bridge on Florida Highway 275 (SW ¼ Sec. 21, T1N, R9W), Calhoun County, Florida, Chipola Formation; UF 112019, body whorl only, with aperture, height 16.5 mm, width 20.1 mm, same locality as previous specimen.

Type Locality: 29°30.05′ N, 85°11.00′ W, Tenmile Creek, at power line crossing about 1.6 km west of Chipola River (SE ¼ Sec. 7, T1N, R10W), Calhoun County, Florida, Chipola Formation.

Etymology: The name *cirritum* is derived from the Latin *cirrus* meaning "filamentous", referring to the fringed costae of the new species.

Discussion: All specimens of *Cirsotrema cirritum* examined lack the apical whorls. It may be assumed that the missing whorls consist of 1 to 3 smooth whorls as evidenced by the remainder of a partial smooth protoconch whorl on the holotype. The width of the axial costae and the intercostal spaces appear to be a variable characteristic on all specimens studied. Features which the eastern Pacific *Cirsotrema togatum* and the western Atlantic *C. dalli* have in common with *C. cirritum* are turreted shape, sculpture on the surface of the costae, and spiral cords with microscopic reticulated sculpture on the body whorl. *Cirsotrema cirritum* differs from *C. togatum* and *C. dalli* by its larger size, narrower costae, wider intercostal areas, and lack of varices. Although the foliated face on the costae of *Cirsotrema togatum* and *C. dalli* presents a flat surface, the foliated adapertural surface of the costae of *C. cirritum* is recurved. Also, a sharply impressed line of demarcation separates each costa from the succeeding intercostal space and next costa on *C. cirritum*, indicating a pause in growth.

The *Cirsotrema* species from the Eocene of the southeastern United States are all under 30 mm, have narrower spiral cords, and lack the reticulated sculpture on the intercostal areas and the crosshatched effect present on the costae of *C. cirritum*. The Eocene *Cirsotrema acutum* (J. Sowerby, 1813) from Great Britain, and the Miocene *C. crassicostatum* (Deshayes, 1850) from Europe are very similar to each other. Both have longitudinal laminations on the costae without the crosshatched effect of *Cirsotrema cirritum*, have narrower, more pronounced spiral cords, and lack the axial striations present on the intercostal spaces of *C. cirritum*. *Cirsotrema acutum* is also smaller and more attenuate posteriorly than *C. cirritum*.

There is no identifiable sculpture visible on Maury's (1925: 242, pl. 37, fig. 4) figure of a very eroded single whorl of the holotype of *Cirsotrema tamanensis* (Maury, 1925) from the Miocene of Trinidad.

Several Recent Indo-Pacific species of *Cirsotrema* have features similar to *C. cirritum*. *Cirsotrema plexis* Dall, 1925, and *C. fimbriatulum* (Masahito, Kuroda and Habe, 1971) may be distinguished from *C. cirritum* as both have varices and have about 20 axial costae on the body whorl as opposed to 13 on *C. cirritum*. Varices are lacking on *Cirsotrema rugosum* (Kuroda and Ito, 1961) and *C. excelsum* Garcia, 2003, but both have a greater number of axial costae on each whorl and the costae differ in sculpture from those of *C. cirritum*. The sculpture on the surface of the axial costae of *Cirsotrema richeri* Garcia, 2003, most closely resembles that of the costae of *C. cirritum*. A greater number of axial costae on the body whorl and the presence of varices on *Cirsotrema richeri* separates it from *C. cirritum*.

Cirsotrema cirritum has only been recorded from the Chipola Formation of northwestern Florida. *Cirsotrema dalli*, which may have originated in the Lower Miocene Chipola Formation, extended its range over southern Florida during the Pliocene and Pleistocene epochs, and survives in the Recent of the western Atlantic Ocean.

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